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TITLE: (6) The limit state of a bar of any profile, subject to combined torsion and tension

PERIODICAL: (15) (TRANS. FROM. Rozprawy inżynierskie, v. 10; no. 3, 1962, pp. 565-579)

TEXT: The problem of combined stress in the purely plastic state resulting from the simultaneous action of a torque M_s and a longitudinal force N is solved in displacements. Sought are the stress distribution, expressions for external forces and equations of the limiting curve in the (M_s, N) plane for any shape of the profile. Assuming the existence of a perfect elastic-plastic incompressible material, the author derives a nonlinear elliptic partial differential equation

$$3\nabla^2\psi + \lambda^2\Omega[\psi] = 0 \qquad (2.18)$$

where ψ = nondimensional distortion function, Ω = nonlinear operator, λ = parameter defining the ratio of torsional and longi-

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tudinal displacements. The expressions for tangential and normal stresses and a parametric equation of the limit curve are given for any profile. (2.18) is solved by Poincaré's method of small parameter. Taking the first approximation one obtains simple relations for the coefficient α characterizing the limit curve for $m_s \ll n$ (m_s, n = dimensionless torque and longitudinal force respectively). Hermitian interpolation extends the range of applicability to $0 \leq m_s \leq 1$, $0 \leq n \leq 1$ and results in the final equation

$$m_s^2 + \left(3 - \frac{1}{a}\right)n^2 + \left(\frac{1}{a} - 2\right)n^3 = 1 \qquad (5.2)$$

valid for any profile. As an example, the equation of the limit curve is given for any polygonal profile, reducing to the known exact solution for the circular bar, when p = no. of sides $\to \infty$. There are 2 figures.

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